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PATENT
Attorney Reference Number 6047-59237-01

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Stefan Uhlenbrock
Application No. 09/882,515
Filed: June 15, 2001
Confirmation No. 1148
For: CHEMICAL VAPOR DEPOSITION METHODS AND APPARATUS
Examiner: Luz L. Alejandro Mulero
Art Unit: 1763
Attorney Reference No. 6047-59237-01

CERTIFICATE OF MAILING

I hereby certify that this paper and the documents referred to as being attached or enclosed herewith are being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: MAIL STOP APPEAL BRIEF – PATENTS, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450 on the date shown below.

Attorney for Applicant(s) Wayne W. Rupert

Date Mailed June 28, 2004

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TRANSMITTAL LETTER

Enclosed for filing in the application referenced above are the following:

- ☒ Appeal Brief (in triplicate)
  - ☒ Appeal Fee of $330.00
- ☒ A check in the amount of $330.00 to cover the above-listed fees
- ☒ The Director is hereby authorized to charge any additional fees that may be required, or credit over-payment, to Deposit Account No. 02-4550. A copy of this sheet is enclosed.
- ☒ Please return the enclosed postcard to confirm that the items listed above have been received.

Respectfully submitted,

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MAIL STOP APPEAL BRIEF - PATENTS
COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

APPEAL BRIEF

In accordance with 37 C.F.R 1.192, this Appeal Brief is being filed in triplicate together with a check in the amount of $330.00 to cover the appeal fee set forth in 37 C.F.R. 1.17(c). The Commissioner is hereby authorized to charge any deficiency in the required fee or to credit any overpayment to Deposit Account No. 02-4550.

I. Real Party in Interest

The real party in interest is Micron Technology, Inc., the assignee of the present application.

II. Related Appeals and Interferences

Appellant is appealing the Patent and Trademark Office's (PTO) rejections of claims in the parent application (Ser. No. 09/468,292; filed December 20, 1999) of this divisional application in Appeal No. 2003-1162 for which a notice of appeal was filed June 21, 2002, and an Amended Appeal Brief was filed on November 15, 2002. To the best of appellant's, the appellant's legal representative, and assignee's knowledge, there are no other related appeals or interferences.

III. Status of Claims

Claims 31-32 and 45-57 are pending. Claims 1-30 and 33-44 have been cancelled. Claims 49 and 55 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Claims 31-32, 45-48, 50-54, and 56-57 are rejected and appealed.

IV. Status of Amendments

No amendments have been filed subsequent to the final Office action.

V. Statement of the Invention

The claims on appeal relate to novel apparatuses and systems for vaporizing substances for vapor deposition onto a substrate. The claimed apparatuses and systems include features to allow dissolution of a substance (referred to as a precursor in the specification) in an ionic liquid, vaporization of the precursor, and deposition of the vaporized precursor onto a substrate. In one embodiment, a stream of gas from a carrier gas source is passed through an ionic liquid source to transport vaporized precursor molecules to a deposition chamber (see the specification, e.g., at page 10, line 22 – page 11, line 22). The ionic liquid source may comprise several classes of ionic liquids, such as those described on page 5, line 1 to page 7, line 27, of the specification.

VI. Issues

(1) Whether claims 31-32, 45-46, and 51-52 are unpatentable under 35 U.S.C. § 103 over appellant admitted prior art (AAPA) in view of Freemantle, "Designer Solvents: Ionic Liquids may Boost Clean Technology Development, C&EN, pp. 32-37 (1998) (Freemantle);

(2) Whether claims 47 and 53 are unpatentable under 35 U.S.C. § 103 over AAPA in view of Freemantle, and further in view of U.S. Patent No. 5,188,914 to Blomgren et al. ("Blomgren");

(3) Whether claims 48 and 54 are unpatentable under 35 U.S.C. § 103 over AAPA in view of Freemantle, and further in view of U.S. Patent No. 4,839,249 to Jones et al. ("Jones");

(4) Whether claims 50 and 56 are unpatentable under 35 U.S.C. § 103 over AAPA in view of Freemantle, and further in view of WIPO Publication WO/ 95/21872 by Abdul-Sada et al. ("Abdul-Sada"); and

(5) Whether claim 57 is unpatentable under 35 U.S.C. § 103 over AAPA in view of Freemantle, and further in view of U.S. Patent No. 4,911,101 to Ballingall, III et al. ("Ballingall").

VII. Grouping of Claims

With respect to issue (1), claims 31-32, 45-46, and 51-52 stand together.

With respect to issue (2), claims 47 and 53 stand together.

With respect to issue (3), claims 48 and 54 stand together.

With respect to issue (4), claims 50 and 56 stand together.

With respect to issue (5), claim 57 stands on its own.

VIII. Argument

The Examiner incorrectly alleges that appellant's novel vaporization and deposition apparatuses and systems utilizing an ionic liquid source to dissolve precursor substances would

have been obvious to one of ordinary skill in the art considering conventional vapor deposition devices in view of Freemantle's disclosure of the existence of and current avenues of research in ionic liquids and further in view of other tertiary references. As discussed in more detail below, one of ordinary skill in the art considering a conventional vapor deposition device would not have found it obvious to modify such a device to utilize an ionic liquid source even in view of Freemantle's disclosure because there is not even a hint in Freemantle that an ionic liquid source should be used in vapor deposition. Thus, the Examiner's rejections fail to adhere to the basic tenet of patent law that "[t]he references . . . must suggest the desirability and thus the obviousness of making the combination" in order to support a rejection under § 103. MPEP § 2141.01. Accordingly, appellant requests that the Board of Patent Interferences and Appeals reverse the Examiner's rejections appealed herein and direct that appellant's claims be allowed.

A. Issue 1 - Claims 31-32, 45-46, and 52-51 would not have been obvious from a combination of any AAPA and Freemantle

These claims recite apparatuses and systems for vaporizing and transporting precursor molecules to a deposition chamber for deposition on a thin film substrate that all include an ionic liquid source, a carrier gas source, and a deposition chamber, among other features. Claims 45-46 and 52-51 further recite specific ionic liquids. The Examiner's primary reference, AAPA, consists of appellant's disclosure of conventional chemical vapor deposition (CVD) systems in which precursors are vaporized or distilled from a conventional CVD solvent and carried to a deposition chamber for deposition onto a substrate. Ionic liquids are not conventional CVD solvents and AAPA does not teach or suggest that a CVD system can or should include an ionic liquid source. See Office action dated 1/28/2004, page 3. The Examiner's secondary reference, Freemantle, cannot overcome this deficiency in AAPA.

1. ***There is no motivation to combine any AAPA with Freemantle***

"The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." MPEP 2143.01 (first emphasis in original, second added). Even where "the references relied

upon teach that all the aspects of the claimed invention were individually known in the art [it] is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references." MPEP 2143.01.

Freemantle merely discloses the existence of a class of substances known as ionic liquids and further discloses generically that these substances can serve as catalysts and/or solvents. See Freemantle, at 32. Freemantle does not disclose that ionic liquids can or should be used to modify conventional CVD techniques or that conventional CVD apparatuses or systems should include an ionic liquid source.

Moreover, Freemantle discloses that, "'[t]he use of ionic liquids is seen as being highly speculative.'" Freemantle, at 34 (emphasis added). The applications for ionic solvents disclosed by Freemantle are couched in terms of "possible refinery" uses, "potential" uses in nuclear fuel reprocessing, and "explor[ing] the use of ionic liquids as catalysts for aromatic alkylation reactions." Freemantle, at 35, 36, and 37, respectively (emphasis added). The only concrete example of a useful application for ionic liquids disclosed by Freemantle is that several IFP plants in France used ionic liquids in a process for converting butene hydrocarbons into larger hydrocarbons for use as the raw materials to synthesize alcohols for use in making polyvinylchloride (PVC). Freemantle, at 35. Such hydrocarbon conversion apparatuses and systems, of course, are quite different from CVD apparatuses and systems. Modification of one type of apparatus and system would not have motivated the same modification of a completely disparate apparatus and system.

Freemantle's disclosure of the existence of ionic solvents and the "highly speculative" nature of their possible usefulness in various industrial applications cannot be said to suggest to the person of ordinary skill in the art that ionic liquids should be used for any particular application. Rather, Freemantle's exposition concerning an increasing interest in ionic liquids and their potential usefulness in some industrial applications at most might make it obvious to try using ionic liquids in a particular industrial application. However, "'[o]bvious to try' has long been held not to constitute obviousness." In re Deuel, 51 F.3d 1552, 1559 (Fed. Cir. 1995). And see Gillette Co. v. S.C. Johnson & Son, Inc., 919 F.2d 720, 725 (Fed. Cir. 1990) ("We have consistently held that 'obvious to try' is not to be equated with obviousness under 35 USC 103."). Moreover, Freemantle does not even suggest trying ionic liquids in CVD or that attempts should be made to design a CVD apparatus or system including an ionic liquid source.

The Examiner takes the position that the claimed invention would have been obvious because of the advantages of ionic liquids as disclosed in Freemantle. See Office action dated January 28, 2004, page 6. In hindsight, the benefits of using ionic liquids in vapor deposition are apparent. But it is the applicant that first made the connection between the properties of the ionic liquids and the advantages such properties offered to vapor deposition. Viewing the matter another way, it is the present specification and not the prior art disclosures that first describe how certain properties of ionic liquids could be utilized in a vapor deposition process.

2. ***The Examiner has not made the required showing that a person of ordinary skill in the art would have had a reasonable expectation of success from combining AAPA and Freemantle***

In addition to failing to show the necessary motivation to combine the cited references, the Examiner also has failed to show or even allege the required element of obviousness that "the prior art would also have revealed that in so making or carrying out, those of ordinary skill would have a reasonable expectation of success." In re Vaeck, 947 F.2d 488, 493 (Fed. Cir. 1991). Nowhere in the record does the Examiner point out how the cited references would have caused one of ordinary skill in the art to expect that ionic liquid could be successfully used in vapor deposition. Moreover, the disclosure in Freemantle explicitly militates against a reasonable expectation of success. Freemantle discloses that the use of ionic liquids is "highly speculative." A person of ordinary skill in the art would not consider Freemantle as providing a reasonable expectation of success in any particular application of ionic liquids in view of such a disclosure. Rather, a person of ordinary skill would assume that the potential for success would be "highly speculative."

B. Issue 2 - Claims 47 and 53 would not have been obvious over AAPA in view of Freemantle, and further in view of Blomgren

Claims 47 and 53 depend from claims 31 and 32, respectively, and further recite particular ionic liquids. The Examiner rejects these claims as allegedly obvious under the same rationale as the rejections of claims 31 and 32, and further cites Blomgren as allegedly supplying

the specific ionic liquids recited in these claims that are not disclosed in Freemantle. The nonobviousness of claims 31-32 is discussed above in part A. As admitted by the Examiner in the Office action of January 28, 2004, Blomgren is "not relied upon to show the use of ionic liquid sources in any particular application." (Page 7.) Because Blomgren admittedly does not provide any additional motivation to combine the cited references or additional evidence of a likelihood of success, Blomgren cannot overcome the fatal deficiencies in Freemantle.

Even assuming, arguendo, that Freemantle did motivate and provide a reasonable expectation of success for a combination of an ionic liquid source and AAPA, Blomgren merely discloses a molten composition comprising a mixture of an inorganic halide salt and a quaternary alkyl phosphonium halide salt. The molten composition is said to be useful as an electrolyte (see, e.g, the Abstract). There is no mention that the molten composition might be useful as a solvent. An individual searching for additional solvents not disclosed in Freemantle certainly would not have been motivated to consult Blomgren since it is completely silent on the topic. Though Freemantle intimates that ionic liquids can be tailored for certain solvent properties, this is much too general to constitute a suggestion to use the type of compositions specifically disclosed in Blomgren in appellants claimed vapor deposition apparatuses. Accordingly, the apparatus and system claimed in claims 47 and 53 are nonobvious not only for the reasons discussed in part A, but also for the unique and nonobvious features recited in these claims.

C. Issue 3 - Claims 48 and 54 would not have been obvious over AAPA in view of Freemantle, and further in view of Jones

Claims 48 and 54 depend from claims 31 and 32, respectively, and further recite particular ionic liquids. The Examiner rejects these claims as allegedly obvious under the same rationale as the rejection of the claims 31-32, and further cites Jones as allegedly supplying the specific ionic liquids recited in these claims that are not disclosed in Freemantle. As admitted by the Examiner in the Office action of January 28, 2004, Jones is "not relied upon to show the use of ionic liquid sources in any particular application." (Page 7.)

For the reasons discussed above in part A, the combination of AAPA and Freemantle does not render obvious a CVD apparatus including an ionic liquid source, as claimed by appellant. Because Jones admittedly does not provide any additional motivation to combine the

cited references or additional evidence of a likelihood of success, Jones cannot overcome the fatal deficiencies in Freemantle.

Even assuming, arguendo, that Freemantle did motivate and provide a reasonable expectation of success for a combination of an ionic liquid source and AAPA, Jones merely discloses a molten composition comprising a mixture of metal halide and a ternary alkyl sulfonium salt. The molten composition is said to be useful as an electrolyte (see, e.g., the Abstract). There is no mention that the molten composition might be useful as a solvent, let alone as a solvent for vapor deposition. Because Jones does not mention or suggest that the composition disclosed therein could be useful as a solvent, the apparatus and system claimed in claims 48 and 54 are nonobvious not only for the reasons discussed in part A, but also for the unique and nonobvious features recited in these claims.

D. Issue 4 - Claims 50 and 56 would not have been obvious over AAPA in view of Freemantle, and further in view of Abdul-Sada

Claims 50 and 56 depend from claims 31 and 32, respectively, and further recite particular ionic liquids. The Examiner rejects these claims as allegedly obvious under the same rationale as the rejection of the claims 31-32, and further cites Abdul-Sada as allegedly supplying the specific ionic liquids recited in these claims that are not disclosed in Freemantle. As admitted by the Examiner in the Office action of January 28, 2004, Abdul-Sada is "not relied upon to show the use of ionic liquid sources in any particular application." (Page 7.)

For the reasons discussed above in part A, the combination of AAPA and Freemantle does not render obvious a CVD apparatus including an ionic liquid source, as claimed by appellant. Because Abdul-Sada admittedly does not provide any additional motivation to combine the cited references or additional evidence of a likelihood of success, Abdul-Sada cannot overcome the fatal deficiencies in Freemantle.

Even assuming, arguendo, that Freemantle did motivate and provide a reasonable expectation of success for a combination of an ionic liquid source and AAPA, Abdul-Sada merely discloses ionic liquids that are said to be useful as reaction media and catalysts for producing olefin polymers. There is no mention that the ionic liquids might be useful as a solvent, let alone as a solvent for vapor deposition. Because Abdul-Sada does not mention or

suggest that the composition disclosed therein could be useful as a vapor deposition solvent, the apparatus and system claimed in claims 50 and 56 are nonobvious not only for the reasons discussed in part A, but also for the unique and nonobvious features recited in these claims.

E. Issue 5 - Claim 57 would not have been obvious over AAPA in view of Freemantle, and further in view of Ballingall

Claim 57 depends from claim 31, and further recites first and second vessels containing first and second precursors. The Examiner rejects this claim as allegedly obvious under the same rationale as the rejection of claim 31, and further cites Ballingall as allegedly supplying the second vessel containing the second precursor recited in this claim that is not disclosed in Freemantle or AAPA.

For the reasons discussed above in part A, the combination of AAPA and Freemantle does not render obvious a CVD apparatus including an ionic liquid source, as claimed by appellant. Ballingall merely discloses a manifold for supplying metal organic vapor to a metal organic molecular beam epitaxy (MOMBE) growth chamber (column 4, lines 15-30), which may include two bubblers (column 9, lines 52-65.) There is no disclosure of ionic liquids in Ballingall, nor any suggestion that the MOMBE manifold should include an ionic liquid source. Because Ballingall does not contain any disclosure related to ionic liquids, Ballingall cannot overcome the fatal deficiencies of Freemantle and AAPA.

IX. Conclusion

The Examiner failed to show any motivation to combine the disclosure of a conventional chemical vapor deposition system in the primary reference (AAPA), with the disclosure of the existence of ionic liquids in the secondary reference (Freemantle) to make the apparatus and system claimed in appealed independent claims 31-32. Moreover, the Examiner failed to show that a person of ordinary skill in the art would have a reasonable expectation of success from such a combination. Indeed, contrary to the Examiner's assertions of obviousness, the Examiner's secondary reference indicates that uses for ionic liquids are "highly speculative." Further, as discussed above, none of the tertiary references cited by the Examiner to reject

Appellant's appealed dependent claims can overcome these deficiencies in the art of record. Accordingly, the Examiner has not established a *prima facie* case of obviousness and this appeal should be sustained with directions to the Examiner to allow the appealed claims.

Respectfully submitted,

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APPENDIX
(Listing of Pending Claims)

31. An apparatus for vaporizing and transporting precursor molecules to a deposition chamber for deposition of a thin film on a substrate, the apparatus comprising:

an ionic liquid source;

a carrier gas source in fluid communication with the ionic liquid source; and

a deposition chamber in fluid communication with the carrier gas source.

32. A system for vaporizing and transporting precursor molecules to a deposition chamber for deposition of a thin film on a substrate, the system comprising:

an ionic liquid source;

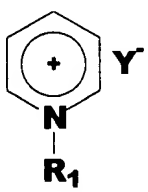
a carrier gas source;

a bubbler device for delivering the carrier gas source to the ionic liquid source; and

a deposition chamber in fluid communication with the ionic liquid source to receive vaporized molecules from the ionic liquid source.

45. The apparatus of claim 31, wherein the ionic liquid is of the formula:

wherein R_1 is alkyl and Y^- is selected from a group consisting essentially of halides, sulfates,

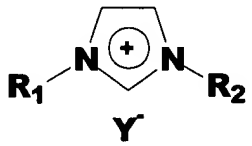


nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$,

chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

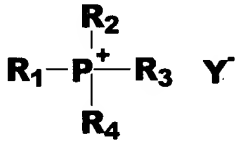
46. The apparatus of claim 31, wherein the ionic liquid is of the formula:

wherein R_1 and R_2 are alkyls and Y^- is selected from a group consisting essentially of halides,



sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

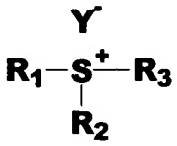
47. The apparatus of claim 31, wherein the ionic liquid satisfies the formula:



wherein R_1, R_2, R_3, R_4 are alkyls and Y^- is selected from a group consisting essentially of halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

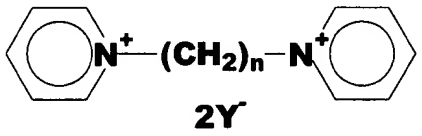
48. The apparatus of claim 31, wherein the ionic liquid satisfies the formula:

wherein R_1, R_2, and R_3 are alkyls and Y^- is selected from a group consisting essentially of



halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

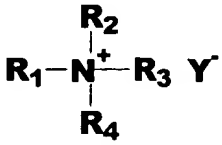
49. The apparatus of claim 31, wherein the ionic liquid satisfies the formula:



wherein n is from about 1 to about 10 and Y^- is selected from a group consisting essentially of halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

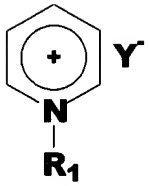
50. The apparatus of claim 31, wherein the ionic liquid satisfies the formula:

wherein R_1, R_2, R_3, R_4 are alkyls and Y^- is selected from a group consisting essentially of



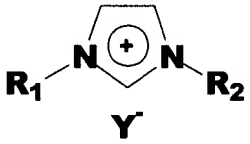
halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

51. The system of claim 32, wherein the ionic liquid is of the formula:



wherein R_1 is alkyl and Y^- is selected from a group consisting essentially of halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

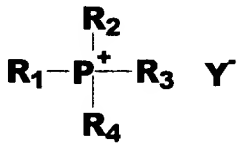
52. The system of claim 32, wherein the ionic liquid is of the formula:



wherein R_1 and R_2 are alkyls and Y^- is selected from a group consisting essentially of halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

53. The system of claim 32, wherein the ionic liquid satisfies the formula:

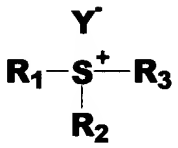
wherein R_1, R_2, R_3, R_4 are alkyls and Y^- is selected from a group consisting essentially of



halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

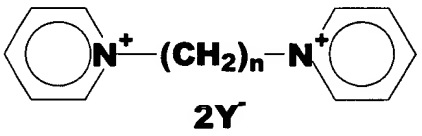
54. The system of claim 32, wherein the ionic liquid satisfies the formula:

wherein R_1, R_2, and R_3 are alkyls and Y^- is selected from a group consisting essentially of



halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

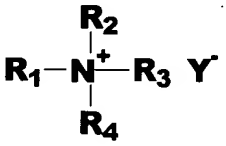
55. The system of claim 32, wherein the ionic liquid satisfies the formula:



wherein n is from about 1 to about 10 and Y^- is selected from a group consisting essentially of halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

56. The system of claim 32, wherein the ionic liquid satisfies the formula:

wherein R_1, R_2, R_3, R_4 are alkyls and Y^- is selected from a group consisting essentially of



halides, sulfates, nitrates, acetates, nitrites, tetrafluoroborates, tetrachloroborates, hexafluorophosphates, $[SbF_6]^-$, chloroaluminates, bromoaluminates, chlorocuprates, heteropolyanions, trifluoromethanesulfonates, and mixtures thereof.

57. An apparatus according to claim 31, further comprising:

a first vessel containing a first precursor and a second vessel containing a second precursor, each first and second vessel in fluid communication with the ionic liquid source, the carrier gas source, and the deposition chamber.